

**PARTICULATE MATTER  
MONITORING NETWORK DESCRIPTION  
FOR THE  
NORTH COAST  
MONITORING PLANNING AREA**

PREPARED BY

Air Quality Data Review Section  
California Air Resources Board

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## **1.0 INTRODUCTION**

This plan provides a description of the PM<sub>2.5</sub> and PM<sub>10</sub> ambient monitoring network designed for the North Coast Monitoring Planning Area (MPA). Airborne particles with aerodynamic diameter less than 10 microns (PM<sub>10</sub>) are small enough to be inhaled. The PM<sub>10</sub> includes fine particles with aerodynamic diameter less than 2.5 microns (PM<sub>2.5</sub>) as a component. The deployment of the PM<sub>2.5</sub> network is critical to the national implementation of the new PM<sub>2.5</sub> National Ambient Air Quality Standards (NAAQS). The ambient data from this network will be used for designating areas as attainment or nonattainment, developing particulate matter control programs, and tracking the progress of such programs.

During the early stages of the PM<sub>2.5</sub> network design process, the Air Resources Board (ARB) and the local air quality management districts established MPAs for the State. The entire State is covered by 18 MPAs. These MPAs will be used for planning monitoring locations for PM<sub>2.5</sub>. They are not intended for designating areas as attainment or nonattainment or planning control measures. The boundaries to be used for these purposes will not be established until adequate PM<sub>2.5</sub> data are available. The ARB and the local air quality management districts will recommend appropriate nonattainment boundaries to the U.S. EPA.

The proposed PM<sub>2.5</sub> monitoring network for the North Coast MPA includes three monitoring sites. All proposed PM<sub>2.5</sub> sites are located at existing PM<sub>10</sub> sites. Each monitoring site will operate a PM<sub>2.5</sub> Federal Reference Method (FRM) monitor. The individual monitors will be operated by the following agencies:

- ▶ Mendocino County AQMD - 1 site.
- ▶ North Coast APCD - 1 sites.
- ▶ Northern Sonoma County APCD - 1 site.

### **1.1. Physical Setting**

The North Coast MPA includes all of North Coast Air Basin, and occupies the extreme northwest corner of California. The area is comprised of two major topographic areas: the Klamath Mountains and the Coastal Range. Both areas are marked by large areas of rugged, mountainous terrain. With winds from a westerly or southwestern direction, the orientation of the topography is such as to form a barrier to restrict air movement. The low lying areas along the coastal strip are properly included within the Coast Range topographic region. These basins include the major industrial and population centers of the air basin.

The coastal lowlands constitute less than ten percent of the area of the North Coast Air Basin. The three most important areas are around the towns of Crescent City, Eureka, and Fort Bragg. Except for Eureka, these towns are enclosed on their landward side by coastal mountains which range from 800 to 1,500 feet in elevation. Under conditions with a low marine inversion, the effective volume of air for dilution of pollutants in these coastal valleys is severely limited.

## 1.2 Population Characteristics

The population of a Metropolitan Statistical Area (MSA) is one of the key parameters in determining the minimum number of required monitoring sites per the U.S. EPA PM2.5 regulations. The North Coast MPA does not include any MSAs. The counties included in the MPA are listed along with population figures in Table 1.2.1.

**Table 1.2.1 Population in the North Coast MPA**

<u>County</u>	<u>Population (in 1990)</u>
Del Norte	22,230
Humboldt	120,310
Mendocino	79,105
Sonoma (P)	63,355
Trinity	14,254
<b>Total Population</b>	<b>299,254</b>

(P) Indicates portion of county within MPA

## 1.3 Climate and Weather

In general, the type of weather experienced at a given location depends on its elevation, latitude, distance from the ocean, and the nature of the terrain between it and the ocean. Although some continental influence can be noted in parts of Sonoma County and in some of the river valleys (e.g., the upper Russian River Valley in Mendocino County), the climate of the most highly populated sections of the North Coast Air Basin is generally a marine climate. During the summer there is fog and sea breezes. Average July temperature is between 50 degrees and 60 degrees F. Winters are mild for the latitude with an overall small annual temperature range. Precipitation increases markedly northward over this region.

## 1.4 Dominant Economic Activities and Emission Sources

The main economic activities for this area are recreation, tourism, forest products, agribusiness, and seafood processing.

The PM2.5 in California's air is the result of primary and secondary particulates. Primary particulate emissions are directly emitted from sources such as residential fireplaces, diesel trucks, forest burning, dust sources, and industrial processes. Secondary particulates form when gaseous or non-particulate substances react in the atmosphere with other substances to produce particulate matter.

The predominant sources of directly emitted PM<sub>2.5</sub> vary regionally in California. In the North Coast MPA, inventory estimates show that the largest contributors of directly emitted PM<sub>2.5</sub> are unpaved road dust, waste burning, residential wood burning, wildfires, and fires. Other sources in the North Coast MPA, like mobile and industrial, are estimated to be less substantial PM<sub>2.5</sub> contributors.

Precursors to secondary PM<sub>2.5</sub> formation in California include oxides of nitrogen (NO<sub>x</sub>) from motor vehicles and other combustion sources, ammonia emissions, certain organic substances which form particulate matter, and additional emission sources. Secondary particulate levels are highly variable and are dependent on atmospheric conditions and precursor levels for formation. For example, in some regions at certain times of the year the secondary particles can comprise 50% or more of the total ambient measured PM<sub>2.5</sub> concentrations. At other times, the secondary particulates are nearly negligible. Because secondary particles form through complex and variable atmospheric processes, it is not currently possible to produce accurate secondary particulate emission estimates as can now be done for the primary, directly emitted PM<sub>2.5</sub>.

## **1.5 PM<sub>2.5</sub> Monitoring Requirements**

Based upon the U.S. EPA PM<sub>2.5</sub> regulations, all Metropolitan Statistical Areas with population greater than 200,000 are required to have a core PM<sub>2.5</sub> SLAMS (this is a site in a populated area representing PM<sub>2.5</sub> concentrations on a neighborhood or urban scale). The required number of core SLAMS and the sampling frequency are determined by the 1990 census population statistics for each MSA. In general, the greater the population in an MSA, the more monitoring sites required for that area. One additional core PM<sub>2.5</sub> monitor that samples everyday is required for each Photochemical Assessment Monitoring Station (PAMS) area included in the MPA.

The regulations also require a PM<sub>2.5</sub> monitor for every 200,000 people living either outside of an MSA or in MSAs with fewer than 200,000 people. These additional monitors are supposed to collect a 24-hour PM<sub>2.5</sub> sample once every three days.

Within the North Coast Monitoring Planning Area, there are no MSAs. Based on the 1990 census, there were 299,254 people living in North Coast. At a minimum, one site is needed to satisfy the requirement for PM<sub>2.5</sub> monitoring within this outlying area. However, more sites will be deployed than the minimum number required in an effort to provide better coverage.

Table 1.5.1 identifies the number of core PM<sub>2.5</sub> monitoring sites to be operated within the North Coast MPA.

**Table 1.5.1 Required and Planned Core PM2.5 Monitoring Sites**

MSA/PMSA/County	Population in 1990	Required Core PM2.5 Monitoring Sites		Planned PM2.5 Sites
		Everyday Sampling	1 in 3 day sampling	
Del Norte	22,230	0	1	0
Humboldt	120,310	0		1
Mendocino	79,105	0		1
Sonoma (P)	63,355	0		1
Trinity	14,254	0		0
<b>Total</b>	<b>299,25</b>	<b>0</b>	<b>1</b>	<b>3</b>

(P) Indicates portion of county within MPA

## **2.0 PM2.5 MONITORING NETWORK ELEMENTS**

This section summarizes PM2.5 monitoring sites planned for deployment in 1998 and 1999. The existing particulate matter monitoring sites will be used for the additional PM2.5 monitoring. The existing particulate matter data have assisted in the design of the PM2.5 network by providing information on the trends and the magnitude of concentrations. These data will be valuable in the future in understanding the particulate size distributions of emission sources and developing control strategies. The particulate matter monitors currently operating at the sites selected for PM2.5 monitoring are also summarized in this section.

Refer to Section 2.0 in the California Particulate Matter Monitoring Network Description for a summary of particulate matter monitoring outside of the PM2.5 monitoring network

### **2.1 PM2.5 Monitors Planned for Deployment**

The planned PM2.5 monitoring network will collect data for multiple objectives, including:

- (1) Comparing sampling results with the PM2.5 NAAQS to determine attainment/nonattainment status.
- (2) Developing and tracking implementation plans for the area.
- (3) Assisting health studies and other ambient aerosol research activities.

In order to understand the nature of the PM2.5 problem in North Coast and to develop control strategies, multiple monitor types will be needed. The PM2.5 Federal Reference Method (FRM) sampler is a gravimetric filter-based sampler that produces a concentration measurement of PM2.5 over a 24-hour period. The FRM alone cannot support the multiple information needs of the PM2.5 network. The sampler design includes a Teflon filter that can experience a loss of volatile constituents, which can be captured and retained better by other sampling techniques. In addition, it does not provide temporally resolved data or full chemical characterization of ambient aerosols.

In addition to FRM monitors, two other types of instruments are required for deployment as part of the PM2.5 network: speciation samplers and continuous mass monitors. Speciation samplers provide a chemical characterization of ambient aerosols for developing emission mitigation strategies and for tracking the success of implemented control programs. Continuous PM2.5 mass monitors will collect data for public reporting of short-term concentrations, for understanding diurnal and episodic behavior of fine particles, and for use by health scientists investigating exposure patterns. However, currently available instruments for continuous measurements of suspended particles mass have many shortcomings. The Tapered Element Oscillating Microbalance (TEOM) sampler uses a heated inlet which causes evaporation of the volatile components of the air sample. The Beta Attenuation Monitor (BAM), which samples at ambient temperatures and relative humidities may overestimate particle concentrations by allowing liquid water to be collected along with particles. Currently there are no plans to deploy



continuous PM2.5 monitors in the North Coast MPA.

The North Coast MPA PM2.5 monitoring network will consist of three monitoring sites. Two of these sites will be deployed in 1998 and one in 1999. Each site will operate an FRM sampler purchased through the National PM2.5 Sampler Procurement Contract established by the U.S. EPA. One monitoring site in the MPA will operate a collocated sampler for quality assurance and quality control evaluation.

A PM2.5 speciation sampler will be deployed at one of the sites in 1999. Table 2.1.1 lists the proposed PM2.5 monitoring sites in the North Coast MPA and the type of instruments planned at these sites. Figure 2.1.1 shows the locations of the proposed sites.

**Table 2.1.1 PM2.5 Monitoring Network Planned for Deployment**

Site Location	AIRS Site ID	PM2.5 FRM	PM2.5 Speciation	PM2.5 TEOM/BAM	Other PM2.5 Monitor
Eureka-Health Department	060231002	X			
Ukiah-County Library	060452001	XX	Y		
Healdsburg-Limeric Lane		Y			

**Codes:**

- X Monitor to be deployed in 1998
- Y Monitor to be deployed in 1999
- XX Collocated particulate monitors used for precision data to be deployed in 1998

## **2.2 Existing Particulate Matter Monitors**

The existing particulate matter State and Local Air Monitoring Stations (SLAMS) network in the North Coast MPA consists of nine monitoring sites. The monitoring instruments operating at these sites include:

- ▶ 9 High Volume Size Selective Inlet (SSI) samplers collecting 24-hour PM10 samples.

All of the proposed PM2.5 sites will be located at existing PM10 sites. Table 2.2.1 summarizes the particulate matter monitoring resources available at the proposed PM2.5 monitoring sites. The complete summary of particulate matter monitoring resources in North Coast can be found in Attachment 1 in the statewide summary.

**Figure 2.1.1**

The particulate matter data obtained from these sites are used to meet the following objectives:

- ▶ Compare measured concentrations to the State and national PM10 standards.
- ▶ Track changes in the particulate matter concentrations over time.
- ▶ Evaluate the population exposure.
- ▶ Assess the impact from transported particulate matter.
- ▶ Assist in health studies and other research.

**Table 2.2.1 Existing Particulate Matter Monitors at Proposed PM2.5 Sites**

Site Location	AIRS Site ID	Dichot	PM10 SSI	PM10 TEOM/BAM	Other PM Monitor
Eureka-Health Department	060231002		X		
Ukiah-County Library	060452001		X		
Healdsburg-Limeric Lane	to be established		X	X	

\* The monitoring site at Healdsburg-Limeric Lane is currently operating as a Special Purpose Monitoring site.

#### **Codes:**

X	Existing monitor
SSI	High Volume Size Selective Inlet sampler collecting 24-hour PM10 samples
Dichot	Dichotomous sampler collecting 24-hour fine fraction and coarse fraction samples
TEOM	Tapered Element Oscillating Microbalance collecting PM10 measurements hourly
BAM	Beta Attenuation Monitor collecting PM10 measurements hourly

## **2.3 PM2.5 Quality Assurance**

The agencies operating PM2.5 monitors in the North Coast MPA will adopt a schedule for implementing quality assurance procedures developed by the ARB. Please refer to Section 3.7 in the statewide summary for more information about the schedule.

## **2.4 Laboratory Analyses**

The FRM instruments collect PM2.5 over 24-hour periods on Teflon-membrane filters from air drawn at a controlled flow rate through a tested PM2.5 inlet. Within 96 hours after the sample collection period, the filter contained in the filter cassette will be removed from the sampler and placed in a protective container. During the period between filter retrieval from the sampler and the start of conditioning, the filter will be maintained at a temperature below 25 degrees centigrade. The filters will be transported to the mass analysis facility. It is currently

proposed that the Bay Area AQMD laboratory will weigh the PM2.5 filters from North Coast MPA, but the final decision has not yet been made. The filters containing PM2.5 samples will be “conditioned” and weighed at the laboratory.

Samples collected from the speciation monitors will be analyzed by a nationwide network of 1 to 3 laboratories. These laboratories will be working under contract performing the necessary laboratory analyses. The establishment of this network of laboratories is still under development, with the specific laboratories yet to be determined.

### **3.0 PM2.5 MONITORING SITES TO BE DEPLOYED IN 1998**

During 1998, two PM2.5 monitoring sites are planned for deployment in the North Coast MPA. This section discusses the criteria used in the selection of the three PM2.5 monitoring sites along with the important parameters that characterize each site.

#### **3.1 Monitor Siting**

The existing particulate matter network in the North Coast MPA consists of nine sites. During the PM2.5 site selection process, the following factors were evaluated:

- ▶ Population statistics and distribution.
- ▶ Land use characteristics.
- ▶ Local climate.
- ▶ Suspected area emission sources (wood smoke, agricultural burning, etc.).
- ▶ Existing particulate matter monitoring network.
- ▶ Existing particulate matter data, including data collected by the dichotomous network, PM10 network, and special studies.
- ▶ Potential transport corridors.
- ▶ Ongoing special health studies.

After the review process, it was determined that existing PM10 sites would be well suited as locations for monitoring PM2.5. None of the PM2.5 sites deployed in 1998 will be located at a new location. All sites selected to operate PM2.5 samplers are located in the more populated areas of the MPA where high PM2.5 concentrations are expected. These sites will also provide useful information about PM2.5 emission sources and population exposure.

#### **3.2 Site Description**

The network for the North Coast MPA, as proposed, includes two sites all of which will be deployed in 1998. The following characteristics apply to all of the proposed sites:

- ▶ Use a Federal Reference Monitor (FRM) type sampler purchased through the national contract established by the U.S. EPA.
- ▶ Sited in a population-oriented location.
- ▶ “Site Type” is Core SLAMS.
- ▶ Represent neighborhood spatial scale.
- ▶ Provide data that will be compared to both the annual standard and the 24-hour standard.

Based on these criteria, the following sites listed in Table 3.2.1 are identified for use for PM2.5 monitoring within the North Coast MPA.

The Ukiah-County Library site was selected to represent an area of maximum PM2.5

concentration in a populated area in the North Coast MPA. The other site, Eureka-Health Department, was selected to represent an area of poor air quality in a populated area. It may not necessarily be in an area of expected maximum concentrations.

These monitoring objectives will be further evaluated during the annual network review period next year when PM<sub>2.5</sub> data will be available from these sites.

**Table 3.2.1 PM<sub>2.5</sub> Monitoring Sites to be Deployed in 1998**

Site Location	AIRS Site ID	Operating Agency	Spatial Scale	Monitoring Objective	Site Type	Measurement Method
Eureka-Health Department	060231002	NCU	Neighborhood	R	C	FRM/SCH
Ukiah-County Library	060452001	MEN	Neighborhood	M	C	FRM/SCH

The following codes are used in this table:

**Operating Agency :**

NCU North Coast Unified AQMD  
MEN Mendocino County AQMD

**Monitoring Objectives:**

R Represent high concentrations in a populated area.  
M Determine the highest concentration expected to occur in the area covered by the network (more than one site per area may be needed).  
T Determine the extent of regional pollutant transport.

**Site Type:**

C Core SLAMS  
S Non-core SLAMS  
P Special Purpose Monitors

**Measurement Method :**

FRM/SCH Federal Reference Method Single Channel Sampler  
FRM/SQ Federal Reference Method Sequential Sampler

#### 4.0 PM2.5 MONITORING SITES TO BE DEPLOYED IN 1999

There are plans to establish an additional PM2.5 monitoring site in 1999 that would operate FRM monitors. The PM2.5 data from this site are intended to help better define the boundaries of nonattainment areas and satisfy other monitoring objectives of the PM2.5 monitoring network. There are plans to deploy a PM2.5 chemical speciation monitor in 1999.

#### 4.1 Monitoring Sites Operating PM2.5 FRM Monitors

There are plans to deploy an additional PM2.5 FRM monitoring site in the southern part of the MPA in 1999. This additional PM2.5 monitoring site will be located at the special purpose monitoring site on Limeric Lane, at the southern end of Healdsburg. The PM2.5 data collected at this site will be used to determine the boundaries of PM2.5 national attainment/nonattainment areas and to evaluate regional PM2.5 atmospheric transport.

**Table 4.1.1 PM2.5 Monitoring Sites to be Deployed in 1999**

Site Location	AIRS Site ID	Operating Agency	Spatial Scale	Monitoring Objective	Site Type	Measurement Method
Healdsburg-Limeric Lane	new site	NSO	Neighborhood	R	C	FRM

NSO Northern Sierra AQMD

R Represent high concentrations in a populated area.

C Core SLAMS

FRM Federal Reference Method sampler

#### 4.2 PM2.5 Chemical Speciation Sampling

The basic objective of the PM2.5 chemical speciation sampling and analysis program is to develop seasonal and annual chemical characterizations and distributions, across the country, of the ambient aerosols present in PM2.5 samples. These chemically resolved data will be used to perform source attribution analyses, evaluate emission inventories and air quality models, and support health related research studies.

The EPA recognizes that sampling for chemical speciation is a developing science, and encourages creative approaches to chemical speciation sampling. The ARB and the local air quality management districts will evaluate existing chemical speciation samplers and select the best-suited instruments for the monitoring conditions in the North Coast MPA. The selected instrument will collect samples for the currently targeted chemical analytes, that include the following:

- ▶ Cations: particulate ammonium, ionic sodium, calcium, and magnesium.
- ▶ Anions: particulate sulfate, nitrate, and chloride.
- ▶ Carbon: total, organic, and elemental.

- ▶ Trace elements: sodium, magnesium, etc., through lead.
- ▶ Semi-volatile organic particles.

The site listed in Table 4.2.1 below was selected for collecting chemically speciated data because it best meets the following list of criteria in the order of importance:

- ▶ High PM<sub>2.5</sub> concentrations, or expected significant contribution of PM<sub>2.5</sub> to high PM<sub>10</sub> concentrations.
- ▶ Located in a area of significant population density.
- ▶ Located in PAMS areas where there is a maximum precursor site for PM<sub>2.5</sub> (this may also be a high concentration site).
- ▶ Significant for atmospheric transport determinations.
- ▶ Geographical representation of a monitored area.

**Table 4.2.1 PM<sub>2.5</sub> Chemical Speciation Sampling**

Site Location	AIRS Site ID	Operating Agency	Monitoring Method
Ukiah-County Library	060452001	MEN	to be determined

MEN Mendocino County AQMD

### 4.3 Continuous PM<sub>2.5</sub> Monitoring

The Federal regulation 40 CFR 58, Appendix D, 2.8.2.3, requires that continuous PM<sub>2.5</sub> samplers be placed in metropolitan areas where there is a population greater than 1 million people. Continuous PM<sub>2.5</sub> data are useful for public reporting of short-term concentrations, for understanding diurnal and episodic behavior of fine particles, and for use by health scientists investigating exposure patterns. The North Coast MPA, with a population of 299,254 based on the 1990 census, is not required to have a continuous PM<sub>2.5</sub> monitor. There are no plans to deploy a continuous PM<sub>2.5</sub> monitor in this MPA.



## 5.0 PM2.5 SAMPLING FREQUENCY

The U.S. EPA requirements call for everyday sampling of PM2.5 at certain core SLAMS sites and one in three day sampling at all other PM2.5 and all PM10 sites. In order to collect sufficient data and at the same time conserve monitoring resources, the ARB and the local air quality management districts are proposing alternative sampling frequencies for PM2.5 and PM10.

### 5.1 PM2.5 FRM Sampling Frequency

Everyday sampling is not required at any of the three sites in the North Coast MPA as specified in the regulations, i.e., two sites per area over 500,000 population and one site per PAMS area. All other core PM2.5 monitoring sites are required to collect a sample once every three days.

Initially, all monitoring sites in the North Coast MPA will sample once every six days. The ARB and the local air quality control agencies will re-evaluate the sampling schedule during the annual network review next year. Monitoring sites with PM2.5 concentrations above the 24-hour standard will be considered for more frequent sampling during.

**Table 5.1.1 PM2.5 FRM Sampling Frequency**

Site Location	AIRS Site ID	Operating Agency	Sampling Frequency	
			Required	Proposed
Eureka-Health Department	060231002	NCU	1 in 3 day	1 in 6 day
Ukiah-County Library	060452001	MEN	1 in 3 day	1 in 6 day
Healdsburg-Limeric Lane	new site	NSO	1 in 3 day	1 in 6 day

NCU      North Coast Unified AQMD  
MEN      Mendocino County AQMD  
NSO      Northern Sonoma County APCD

### 5.2 PM2.5 Chemical Speciation Sampling Frequency

The federally required sampling frequency for PM2.5 chemical speciation is once in 12 days. This sampling frequency may not be sufficient in some cases to adequately support plans to control PM2.5 source emissions. The appropriate sampling frequency will be determined at a later date and will depend largely on PM2.5 data needs and available resources.

### 5.3 PM10 Sampling Frequency

The new U.S. EPA minimum requirement for PM10 sampling frequency is once every

three days. The Air Resources Board and the local air pollution control districts in California are requesting that the U.S. EPA Region 9 grant a statewide waiver allowing sampling at the current schedule of 1-in-6-days, with certain exceptions to be determined on a case by case basis. To demonstrate a change in the attainment status of the national 24-hour PM10 standard, more frequent sampling may be needed. Monitoring sites with maximum 24-hour concentrations close to the 24-hour standard may be required to sample everyday or at least on a 1-in-3-day schedule.